Lesson 18: Four Interesting Transformations of Functions

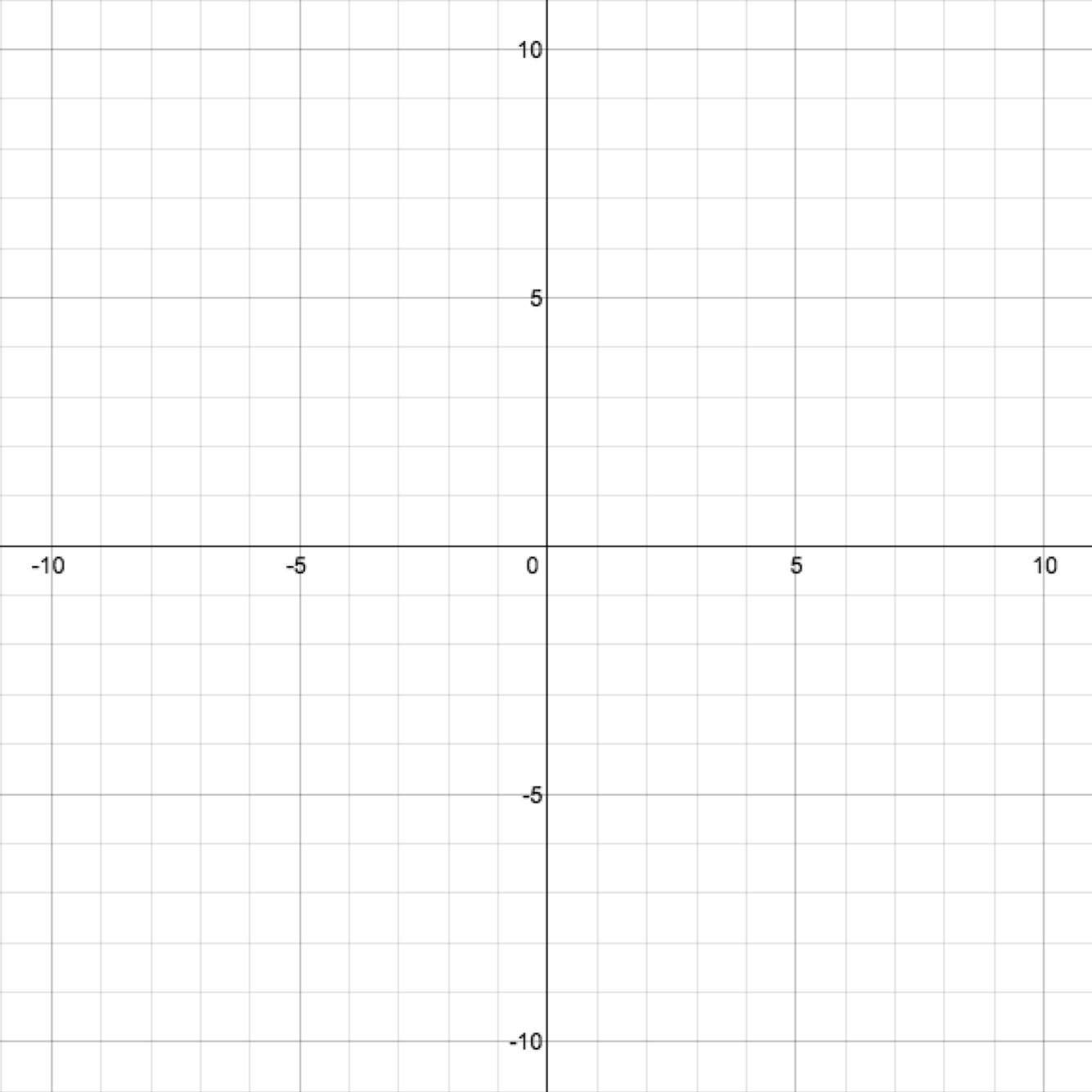
Classwork

**Example 1**

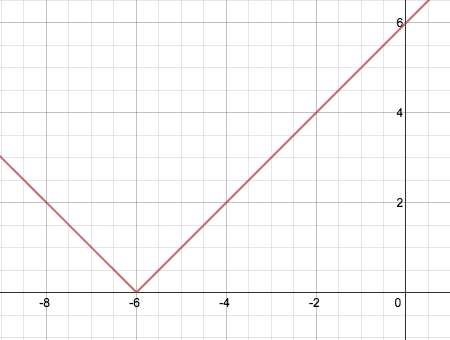
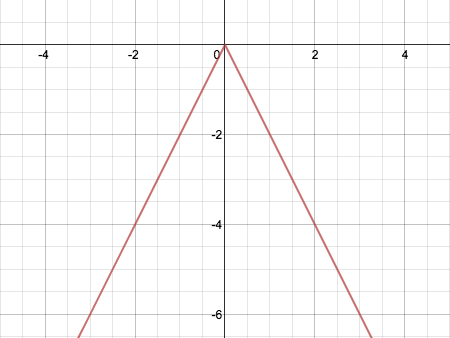
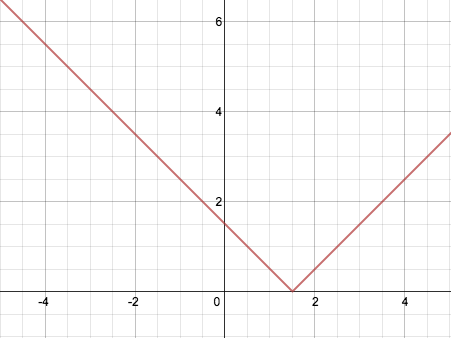
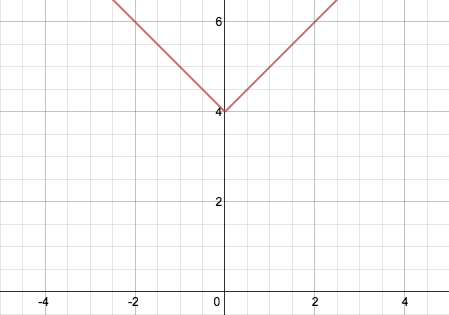
Let , , where can be any real number.

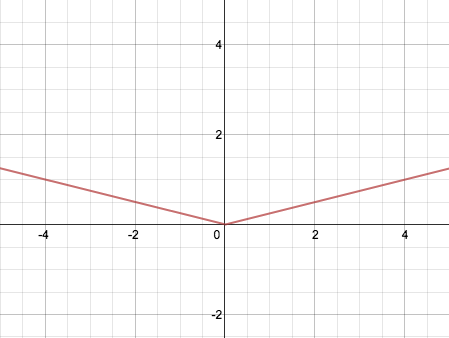
* 1. Write the formula for in terms of (i.e., without using notation):
  2. Write the formula for in terms of (i.e., without using notation):
  3. Complete the table of values for these functions.

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* 1. Graph all three equations: , , and **.**
  2. How does the graph of relate to the graph of ?
  3. How does the graph of relate to the graph of ?
  4. How does the graph of and the graph of relate differently to the graph of ?
  5. How do the values of and relate to the values of ?

Exercises

1. Karla and Isamar are disagreeing over which way the graph of the function is translated relative to the graph of . Karla believes the graph of is “to the right “of the graph of , Isamar believes the graph is “to the left.” Who is correct? Use the coordinates of the vertex of and and to support your explanation.
2. Let where can be any real number. Write a formula for the function whose graph is the transformation of the graph of given by the instructions below.
   1. A translation right 5 units.
   2. A translation down 3 units.
   3. A vertical scaling (a vertical stretch) with scale factor of .
   4. A translation left 4 units.
   5. A vertical scaling (a vertical shrink) with scale factor of .
3. Write the formula for the function depicted by the graph.
   1. 
   3. 



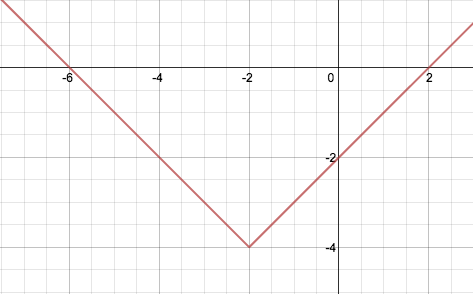
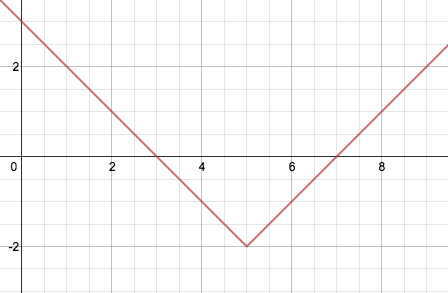
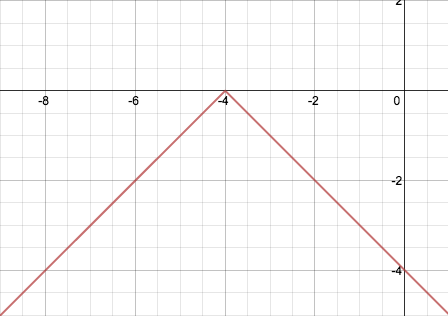
1. Let where can be any real number. Write a formula for the function whose graph is the described transformation of the graph of .
   1. A translation units left and units down.

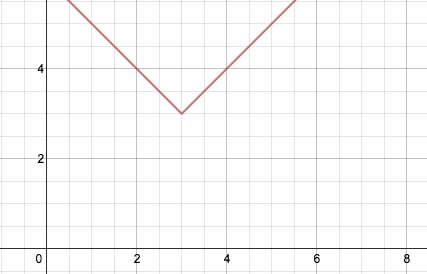
* 1. A translation units right and unit up.

* 1. A vertical scaling with scale factor , and then a translation units right.

* 1. A translation units right and a vertical scaling by reflected across the -axis with vertical scale factor .

1. Write the formula for the function depicted by the graph.

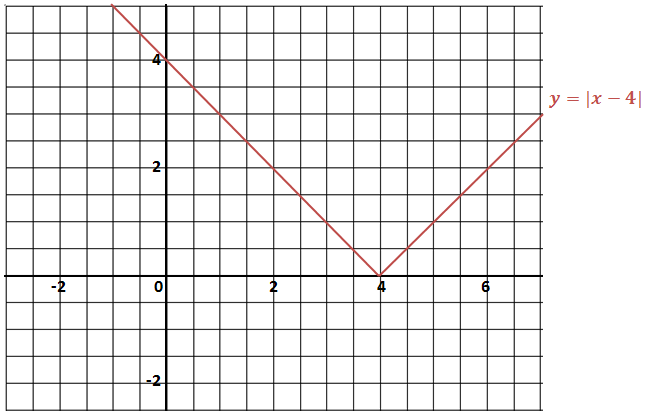
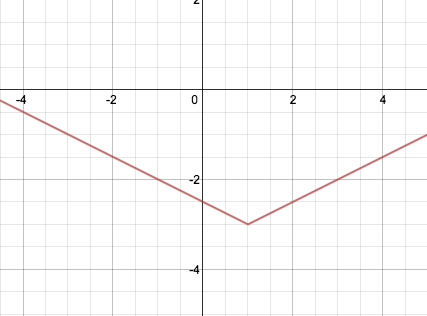
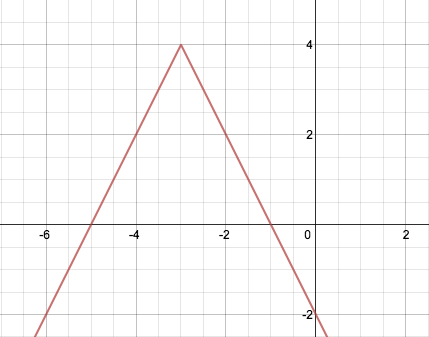


* 1. 

Problem Set

1. Working with quadratic functions.
   1. The vertex of the quadratic function is at , which is the minimum for the graph of Based on your work in this lesson, to where do you predict the vertex will be translated for the graphs of and ?
   2. Complete the table of values and then graph all three functions.

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1. Let for every real number . The graph of the equation is provided on the Cartesian plane below. Transformations of the graph of are described below. After each description, write the equation for the transformed graph. Then, sketch the graph of the equation you write for part (d).
   1. Translate the graph left units and down units.
   2. Reflect the resulting graph from part (a) across the -axis.
   3. Scale the resulting graph from part (b) vertically by a scale factor of .
   4. Translate the resulting graph from part (c) right units and up units. Graph the resulting equation.
2. Let for all real numbers . Write the formula for the function represented by the described transformation of the graph of .
   1. First, a vertical stretch with scale factor is performed, then a translation right units, and finally a translation down unit.
   2. First, a vertical stretch with scale factor is performed, then a reflection over the -axis, then a translation left units, and finally a translation up units.
   3. First, a reflection across the -axis is performed, then a translation left 4 units, then a translation up 5 units, and finally a vertical stretch with scale factor 3.
   4. Compare your answers to parts (b) and (c). Why are they different?
3. Write the formula for the function depicted by each graph.
   1. **